What is claimed is:

1   1.   A method for estimating a remaining lifetime of a part in a piece of semiconductor

2   fabrication equipment, comprising the steps of:

3   selecting a plurality of factors relevant to the remaining lifetime of the part, the plurality

4   of factors including a number of semiconductor wafers that have been processed by the piece of

5   semiconductor fabrication equipment since the part was installed in the piece of equipment; and

6   estimating the remaining lifetime of the part by a fuzzy inference.

1   2.   The method of claim 1, wherein the plurality of factors include a length of time that the

2   part has been used.

1   3.   The method of claim 2, further comprising replacing the part when the estimated

2   remaining lifetime falls below a threshold value.

1   4.   The method of claim 2, wherein the fuzzy inference is based on the following fuzzy rule

2   set, in which P is the number of semiconductor wafers that have been processed by the piece of

3   semiconductor fabrication equipment since the part was installed in the piece of equipment, T is

4   the length of time that the part has been used, and L is the remaining lifetime of the part:

5   if P is small, and T is small, then L is large;

6   if P is medium, and T is small, then L is medium;

7   if P is large, and T is small, then L is small;

8   if P is small, and T is medium, then L is large;

9   if P is medium, and T is medium, then L is medium;

10   if P is large, and T is medium, then L is small;

11   if P is small, and T is large, then L is medium;

12   if P is medium, and T is large, then L is medium; and

13   if P is large, and T is large, then L is small.

1   5.   The method of claim 2, wherein the fuzzy inference is based on a fuzzy rule set

2   determined using empirical experience.

1 6.   The method of claim 2, further comprising the step of automatically collecting the

2 following data for the part: the number of semiconductor wafers that have been processed by the

3 piece of semiconductor fabrication equipment since the part was installed in the piece of

4 equipment, and the length of time that the part has been used.

1 7.   The method of claim 1, wherein:

2   the plurality of factors include a length of time that the part has been used;

3   wherein the fuzzy inference is based on the following fuzzy rule set determined using

4 empirical experience, in which P is the number of semiconductor wafers that have been

5 processed by the piece of semiconductor fabrication equipment since the part was installed in the

6 piece of equipment, T is the length of time that the part has been used, and L is the remaining

7 lifetime of the part:

8   if P is small, and T is small, then L is large;

9   if P is medium, and T is small, then L is medium;

10   if P is large, and T is small, then L is small;

11   if P is small, and T is medium, then L is large;

12   if P is medium, and T is medium, then L is medium;

13   if P is large, and T is medium, then L is small;

14   if P is small, and T is large, then L is medium;

15   if P is medium, and T is large, then L is medium; and

16   if P is large, and T is large, then L is small.

1 8.   A system for estimating a remaining lifetime of a part in a piece of semiconductor

2 fabrication equipment, comprising:

3   means for automatically collecting and storing data representing the number of

4 semiconductor wafers that have been processed by the piece of semiconductor fabrication

5 equipment since the part was installed in the piece of equipment;

6   fuzzy inference means for determining degrees of fulfillment of a plurality of rules based

7 on a plurality of factors relevant to the remaining lifetime of the part, the plurality of factors

8   including a number of semiconductor wafers that have been processed by the piece of

9   semiconductor fabrication equipment since the part was installed in the piece of equipment; and

10   a defuzzifier for estimating the remaining lifetime of the part based on the degrees of

11 fulfillment of the plurality of rules.

1   9.   The system of claim 8, wherein the plurality of factors include a length of time that the

2   part has been used.

1   10.   The system of claim 9, wherein the rules include the following fuzzy rule set, in which P

2   is the number of semiconductor wafers that have been processed by the piece of semiconductor

3   fabrication equipment since the part was installed in the piece of equipment, T is the length of

4   time that the part has been used, and L is the remaining lifetime of the part:

5   if P is small, and T is small, then L is large;

6   if P is medium, and T is small, then L is medium;

7   if P is large, and T is small, then L is small;

8   if P is small, and T is medium, then L is large;

9   if P is medium, and T is medium, then L is medium;

10   if P is large, and T is medium, then L is small;

11   if P is small, and T is large, then L is medium;

12   if P is medium, and T is large, then L is medium; and

13   if P is large, and T is large, then L is small.

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